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On the Minor Planet Feronia (71).* By Dr. C. H. F. Peters.

The observations made at the Hamilton College Observatory upon *Maja*, as it was supposed (see Brünnow's *Ast. Not.*, No. 27), from the 29th of May, belong, as Mr. Truman H. Safford has found, to another planet hitherto unknown. Having received, by the kindness of Professor Bond, the places of the comparison-stars from the *Harvard Zones*, not yet printed, I have been enabled to complete the reduction of the eight positions obtained between the 29th of May and 13th of June, and I have computed the following orbit for the new planet:—

Epoch, 1861, Jan. 0·0 Washington M.T.

	° ′ ″	
M_0	211 50 4·27	
π	317 39 5·63	Mean Equinox of Epoch.
☊	207 56 24·36	
i	5 21 58·33	
φ	7 0 15·84	
μ	1086″·924	
Log a	0·3425384	

The semi-axis major appears to be the smallest known of the asteroids, even a little smaller than that of *Flora;* which relation, however, of course is liable to be changed by further observations. The elements were derived from May 30, June 7, and June 13, with regard to the smaller corrections, and represent the whole series as follows:—

	Observed R.A.	C — O.	Observed Decl.	C — O.
	° ′ ″	″	° ′ ″	″
May 29	176 39 11·5	+3·2	+0 36 12·8	+2·2
30	176 47 34·2	+0·1	35 8·3	+0·3
31	176 56 15·6	−2·8	33 50·4	+1·4
June 1	177 5 18·6	−3·4	32 22·2	+1·6
7	178 6 27·6	+0·3	20 0·2	+0·5
8	178 17 41·4	−3·2	17 25·2	−0·9
10	178 41 14·6	+1·2	11 39·6	−1·7
13	179 18 35·1	0·0	+0 1 54·7	−0·1

The remaining errors are perhaps not larger than may be expected of observations by the ring-micrometer, and upon an object of about 13th magnitude; part of the differences, besides, may be owing to the star-positions. On May 31 and June 1, for example, the same comparison-star was used. The observation on May 29 is not very good; only few comparisons could be obtained.

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* See p. 170, where the Planet is called (72). *Feronia* being (71), *Niobe* will be (72).—Ed.

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In opposition the planet will appear of about the 11th magnitude; and there will be, therefore, no difficulty to find it again on or before the next one, which will happen in September.

At my request Mr. Safford has selected the name; and the number ought to be (71), in accordance with the date of the first observation.

In the *Comptes Rendus* (6 Jan., 1862) there is contained an article by M. Leverrier, "On the System of the Planets *Mercury*, *Venus*, the *Earth*, and *Mars*," giving a survey of his researches, as consisting of the three distinct parts, a new examination of the theories, a new discussion of the observations, and lastly, the comparison of the theories and observations. The provisionally assumed masses were

$$\text{Mercury} \quad m = \frac{1+\nu}{3000000}$$

$$\text{Venus} \quad m' = \frac{1+\nu'}{401847}$$

$$\text{The Earth} \quad m'' = \frac{1+\nu''}{354936}$$

$$\text{Mars} \quad m''' = \frac{1+\nu'''}{2680337}$$

ν, ν', ν'', ν''' being quantities to be determined.

But to make the results of the theory agree with the observations it would be necessary to attribute to these quantities values which are altogether inadmissible. For instance, the discussion of the secular variation of the perihelion of *Mercury* leads to the equation $87'' \nu'' = +45'', 5$, or the mass of the Earth would require to be increased by nearly one-half its value, and it thus becomes necessary to explain the greater part of the excess of the observed motion of the perihelion of *Mercury* by some extraneous action.

The serious difficulties which present themselves in the motion of the four planets, reduce themselves to the three principal ones; 1°, the excess of the motion of the perihelion of *Mars;* 2°, the excess of the motion of the node of *Venus;* 3°, the excess of the motion of the perihelion of *Mercury.*

The first two difficulties appear to arise from the same cause, the one and the other would be removed by an increase in the mass of the Earth, and this would indicate a perturbing cause placed between the two planets *Venus* and *Mars*. But, M. Leverrier asks, does it follow that the mass of the Earth must really be augmented, or may not the disturbing mass (the action of which should be about equal to a tenth

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part of the mass of the Earth) be detached from the Earth, and in this case in what manner is it distributed?

Among the objections, which seem not to permit the necessary addition to be made to the mass of the Earth, is the following; viz., an increase of one-tenth part in the mass of the Earth would disturb the relation that exists between the force of gravity at the surface of the Earth, the mass of the Earth, and the solar parallax, unless the solar parallax were increased by one thirtieth part.

The difficulties disappear by admitting that the perturbing mass is distributed among a considerable number of asteroids, such as exist between *Mars* and *Jupiter*, and whereof only the largest, it is probable, are observed; or such as observation shows to exist at a distance sensible equal to that of the Earth. Such a system of corpuscules would act especially on the perihelion of a planet having a considerable excentricity, and would give it a direct motion; it would less affect, or would not affect at all, the excentricity. It would be therefore, in the motion of the perihelion, attributed exclusively to the terms in the formulæ not depending on the longitude of this element, that a result can be obtained as to the total mass of these corpuscules.

But there is no means of deciding how much of the action is to be attributed to the group at the same distance as the Earth, and how much to the group between *Mars* and *Jupiter*. All that can be done is to assign superior limits to the masses of these groups respectively, by attributing to each of them successively the whole excess in the motion of the perihelion of *Mars*.

Assuming that the perihelia of the disturbing masses are uniformly distributed as to longitude, the results are,—

1°. If the whole excess in the motion of the perihelion of *Mars* is attributed to a ring of asteroids situate at a distance from the Sun equal to that of the Earth, the total mass of these asteroids will be somewhat greater than that of *Mars*, and will be equal to the fraction 0·138 of the mass of the Earth.

2°. If the whole excess is attributed to a group of asteroids between *Mars* and *Jupiter* (distance from the Sun between 2·20 and 3·16) the total mass of the group will be about one third of that of the Earth.

It is now, M. Leverrier thinks, established (*il reste acquis*) that it is not possible to represent all the observations of the system of the four inferior planets, by taking account only of their mutual actions and that of the Sun. But, at least, the difficulties are recognised and circumscribed in such manner that their solution cannot but be obtained, since astronomers now know the direction in which their efforts are to be made. On the one hand, the excess of the motion of the perihelion of *Mercury* is to be accounted for; and if the change of the

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obliquity of the equator, deduced from the observations, be accepted, it is necessary to have recourse to the action of an extraneous and hitherto unknown cause. On the other hand, the analogous excess in the motion of the perihelion of *Mars* is to be accounted for; and, if the value of the solar parallax, deduced from the transits of *Venus*, be accepted, recourse must again be had to the action of an extraneous cause.

Disregarding the exceptional facts, and preserving the solar parallax 8″·58, the masses are definitively found to be,

$$\begin{aligned} &\text{Mercury} && m = \frac{1}{4348000} \\ &\text{Venus} && m' = \frac{1}{412150} \\ &\text{The Earth} && m'' = \frac{1}{354030} \\ &\text{Mars} && m''' = \frac{1}{2968300} \end{aligned}$$

which are the values adopted in M. Leverrier's tables.

Captain Shea continues to communicate to the Society his Observations of Solar Spots, now extending over a period of 15 years.

Mr. Samuel Sharpe, of Highbury Place, has presented to the Society a 10-inch Reflecting Circle, by Troughton, with its counterpoise stand.

RECENT PUBLICATIONS.

Astronomische Beobachtungen auf der Sternwarte zu Bonn. Von Dr. Fr. W. A. Argelander. Dritter Band, Bonner Sternverzeichniss, Erste Section. Bonn, 1859. Vierter Band, Bonner Sternverzeichniss, Zweite Section, Bonn, 1861.

The first section contains the approximate mean places of 110984 stars between the declinations 2° south and 20° north, for the beginning of the year 1855; the second section the approximate mean places of 105075 stars between 20° and 41° north declination for the same epoch, observed and calculated with the co-operation of Dr. E. Schönfeld and Dr. A. Kruger, by Dr. Argelander, Director of the Observatory.

An account of the progress of this great work of the Survey of the Northern Hemisphere, communicated by the direction of Dr. Argelander, has recently appeared in the *Monthly Notices*, see the December number, p. 57.